

***EUPTERYX ATROPUNCTATA*: NORTH AMERICAN DISTRIBUTION,
SEASONAL HISTORY, HOST PLANTS, AND DESCRIPTION OF
THE FIFTH-INSTAR NYMPH (HOMOPTERA: CICADELLIDAE)**

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Abstract.—*Eupteryx atropunctata* (Goeze), a Palearctic leafhopper known pre-
viously in North America from Connecticut, Ontario, and Quebec, is recorded
from Michigan, New York, and Pennsylvania. Seasonal history was studied at
Ithaca, N.Y., during 1980-82. Overwintering occurs in the egg stage; eggs begin
to hatch in early May, and at least four generations develop by November.
This mesophyll feeder produces chlorotic or stippled areas on upper leaf surfaces
of host plants. A list of 34 hosts, mostly medicinal and herb garden plants of the
Lamiaceae (= Labiatae), is given. A diagnosis of the adult is provided, and the
fifth-instar nymph is described and illustrated.

Eupteryx atropunctata (Goeze), a typhlocybine leafhopper occurring throughout
most of Europe (Metcalf, 1968; Nast, 1972), feeds on a variety of herb garden
and crop plants. In England it is part of an herb-feeding complex of closely allied
species; LeQuesne (1973) presented a key to separate *E. atropunctata* from *E.*
aurata (L.) and *E. origani* Zakhvatkin. *Eupteryx atropunctata* is often common
on medicinal plants, especially labiates such as *Mellisa officinalis* L., *Mentha*
piperita L., and *Salvia officinalis* L. (Nowacka and Adamska-Wilczek, 1974), and
Ballota, *Lamium*, *Marrubium*, *Nepeta*, and *Origanum* (Ossiannilsson, 1943). The
broad host range also is known to include the composites sunflower (Nowacka
and Bielejewski, 1978); burdock, *Arctium lappa* L. (Fokker, 1891); and *Petasites*
officinalis Moench (Blattny, 1924). Linnavuori (1952) reported it from *Filipendula*
ulmaria (L.) Maxim (Rosaceae); Günthart (1971) found it on *Apium* sp. (Api-
aceae = Umbelliferae); and Blattny (1924) recorded it from *Althaea officinalis* L.
(Malvaceae).

Eupteryx atropunctata has long been known from potato (Curtis, 1860), on
which characteristic chlorotic spots appear at feeding sites (Horne and Lefroy,
1915). Feeding also may cause leaf edges to curl, producing symptoms that re-
semble those of potato leaf curl (Heinze, 1937); this leafhopper, however, appears
not to transmit leaf curl virus. From a study of populations on potato, Gromadzka
(1970) reported two annual generations for *E. atropunctata* with overwintering
possibly occurring in the adult stage.

Because of its association with crop plants in the Old World, including sugar
beet, Quaintance (1913) listed *E. atropunctata* as an exotic pest that eventually

might be introduced to the United States. *Eupteryx mellisae* Curtis, a leafhopper occurring in England on some of the same hosts used by *E. atropunctata* (Douglas, 1879), already had been detected in the U.S. (McAtee, 1919; Leonard and Barber, 1923). Osborn (1929), in calling attention to the ease with which leafhoppers can be imported as eggs concealed in plant material, regarded *E. mellisae* as artificially introduced.

Moore (1950), the first to record *E. atropunctata* from North America, reported it from Isle Jesus, near Montreal, Quebec. Beirne (1956) noted that *E. atropunctata* is "widely distributed in southern Ontario and Quebec," and gave hollyhock (*Althaea rosea* Cav.) as the host plant. Until recently, no further attention was given this introduced species.

During the "High Hazard Pest Survey" conducted by USDA-APHIS, Hoebeke (1980) identified this Palearctic leafhopper from the United States, based on a collection from beans, *Phaseolus vulgaris* L., at Willimantic (Windham Co.), Connecticut, in July 1979. New records have since become available from additional USDA survey work and from our own collecting in New York and Pennsylvania. In this paper we record the known North American distribution and host plants of *E. atropunctata*, summarize our observations on biology and seasonal history at Ithaca, N.Y., and describe and illustrate the adult and fifth-instar nymph.

North American distribution.—In addition to the published records from Ontario and Quebec in Canada and the U.S. record from Connecticut, the following new records of *E. atropunctata* can be given. The Michigan collections are the result of the USDA-APHIS survey; the New York and Pennsylvania records are based on our collecting. The host plants for this leafhopper in New York and Pennsylvania are recorded in Table 1.

MICHIGAN: *Calhoun Co.*, Homer, 12 June 1980, W. A. Martin, on potato. *Eaton Co.*, Eaton Rapids, 10 July 1980, W. A. Martin, on potato; Grand Ledge, 19 June 1980, W. A. Martin, on potato.

NEW YORK: *Cayuga Co.*, Auburn, 26 June 1982, ERH and AGW; near Locke, 11 July 1981, ERH and AGW. *Chemung Co.*, Elmira, 18 July 1981, ERH and AGW; Wellsburg, 27 June 1982, AGW. *Cortland Co.*, Cortland, 11 July 1981, ERH and AGW. *Erie Co.*, Sardinia, 19 May 1981, ERH; Tonawanda, 13–14 June 1981 and 1982, ERH. *Genesee Co.*, Bergen and Le Roy, 31 July 1982, ERH and AGW. *Onondaga Co.*, Elbridge-Camillus Townline and Solvay, 26 June 1982, ERH and AGW. *Seneca Co.*, Hayts Corners, 10 June–8 July 1981, ERH. *Tioga Co.*, near Spencer, 19 July 1981, ERH and AGW. *Tompkins Co.*, Ithaca area and Cornell Univ. campus, 8 June–14 September 1980, and 3 May–24 December 1981, ERH and AGW; Ludlowville, 23 May 1981, ERH; Town of Ulysses, near Jacksonville, 18 October 1981, and May–June 1982, ERH. *Wayne Co.*, Lyons, 31 July 1982, ERH and AGW.

PENNSYLVANIA: *Bedford Co.*, Bedford, 2 July 1981, AGW. *Blair Co.*, Altoona, 14 May 1981, AGW. *Centre Co.*, State College, 19 June 1980, and 17 June–29 October 1981, AGW. *Columbia Co.*, Numidia, 7 July 1982, AGW. *Cumberland Co.*, Carlisle, 14 July 1982, AGW. *Franklin Co.*, near Fannettsburg, 14 July 1982, AGW. *Fulton Co.*, McConnellsburg, 14 July 1982, AGW. *Montour Co.*, near Danville, 10 June 1980, AGW. *Susquehanna Co.*, Great Bend, 30 July 1981, AGW.

Table 1. Host plants of *Eupteryx atropunctata* in New York and Pennsylvania, 1980–82.

Species	Common Name
Malvaceae	
<i>Althaea ficifolia</i> L.	hollyhock
<i>A. rosea</i> L.	hollyhock
Primulaceae	
<i>Primula japonica</i> A. Gray	primrose
Lamiaceae (= Labiatae)	
<i>Agastache foeniculum</i> Pursh (O. Kuntze)	anise hyssop
<i>Ajuga pyramidalis</i> L.	bugleweed
<i>Glechoma hederacea</i> L.	gill-over-the-ground
<i>Lamium maculatum</i> L.	spotted dead nettle
<i>Mentha aquatica</i> L. var. <i>crispus</i> (L.) Benth.	water mint
<i>M. spicata</i> L.	spearmint
<i>Monarda didyma</i> L.	bee balm
<i>Nepeta cataria</i> L.	catnip
<i>N. × faasseni</i> Bergmans ex Stearn	catnip
<i>N. grandiflora</i> Bieb.	showy catnip
<i>N. mussinii</i> K. Spreng. ex Henckel	catnip
<i>Ocimum sanctum</i> L.	holy basil
<i>Origanum marjorana</i> L.	sweet marjoram
<i>O. pulchellum</i> (Boiss.) O. Kuntze	marjoram
<i>O. vulgare</i> L.	marjoram
<i>Salvia argentea</i> L.	silver salvia
<i>S. officinalis</i> L.	common sage
<i>S. pratensis</i> L.	meadow clary
<i>S. verticillata</i> L.	lilac sage
<i>S. viridis</i> L. 'Blue Bird'	annual clary sage
<i>S. 'Red Hussar'</i>	
<i>Stachys grandiflora</i> (Willd.) Benth.	betony
Scrophulariaceae	
<i>Verbascum lychnitis</i> L.	white mullein
<i>V. olympicum</i> Boiss.	
<i>Veronica latifolia</i> L. (= <i>teucrium</i>)	speedwell
<i>V. longifolia</i> L.	speedwell
<i>V. officinalis</i> L.	common speedwell
Asteraceae (= Compositae)	
<i>Ageratum</i> 'Blue Tango'	
<i>Arctium minus</i> (Hill) Bernh.	common burdock
<i>Inula orientalis</i> Lam.	caucasian inula
Verbenaceae	
<i>Verbena</i> 'Ideal Florist's Mix'	

Seasonal history and host plants.—In June 1980 we discovered a large population of *E. atropunctata* in several herb and flower gardens on the Cornell University campus at Ithaca, N.Y. We made notes on phenology at irregular intervals through September and recorded host plants. In 1981 we made weekly or biweekly collections from early May through December (with the exception of mid-September) to determine a generalized pattern of seasonality. Foliage of *Salvia pra-*

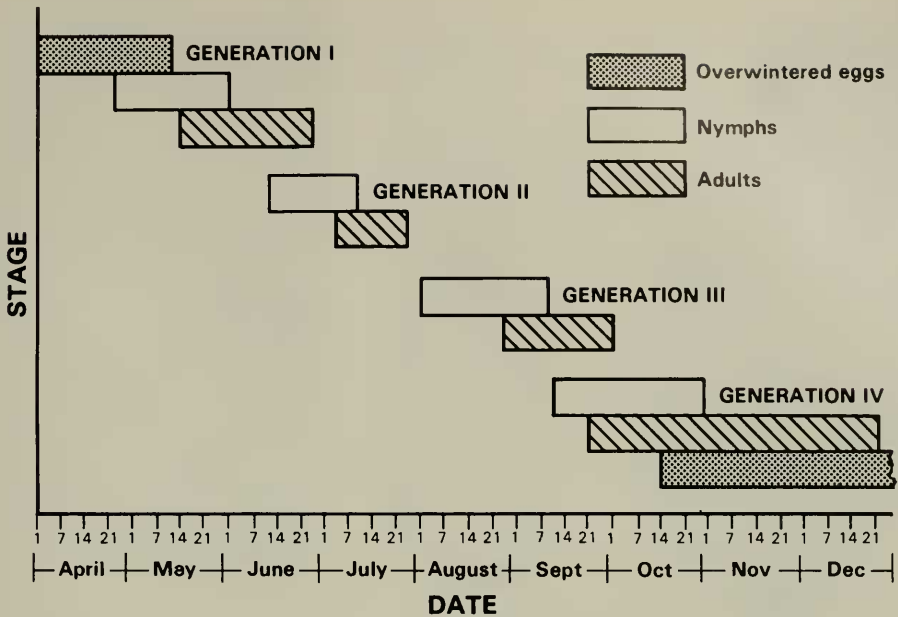


Fig. 1. *Eupteryx atropunctata*. Generalized seasonal history at Ithaca, N.Y., 1980-82.

tensis L. and *Stachys grandiflora* was examined for leafhoppers and the predominant stages present (except eggs) were recorded. Supplemental seasonal history observations were made throughout the season at other New York localities and in Pennsylvania. Early-season collections were made in 1982 to establish the overwintering stage.

On 3 May 1981 we found early instars in the absence of adults and therefore assumed that *E. atropunctata* overwintered in the egg stage as noted by Müller (1957) and Schiemenz (1969) in Europe. Because adults were collected on the undersides of *Salvia* leaves as late as 24 December in 1981, it seemed possible that adults might overwinter in certain years. Gromadzka (1970) suggested that overwintering occurred in the adult stage in Poland. In 1982 we were able to confirm that the eggs overwinter. Egg hatch in the Ithaca area began during late April to early May, and teneral adults of the first generation were found by 18 May in 1981 (see Fig. 1). Adults appeared at this time at nearby sites and at State College, Pa. Early instars of a second brood were first collected in mid-June; adults began to appear by the first week of July. Early instars again were found in early August, indicating the beginning of a third generation. Our collections show that most third brood nymphs develop during mid-August to early September and suggest that the presence of first-instar nymphs in mid-October marked the beginning of a fourth generation. It is also possible that the overlapping of generations, which makes brood delineation more difficult later in the season, obscured a fifth generation. Only four generations, however, are shown in Fig. 1.

In Switzerland, Günthardt and Wanner (1981) noted that *E. atropunctata* is a bivoltine species, and Gromadzka (1970) stated that two generations develop on potato in Poland, although the crop apparently was sampled only from early July



Figs. 2-3. *Eupteryx atropunctata*. 2, Leaf of *Veronica* sp. showing chlorosis produced by mesophyll feeding. 3, Adult habitus, dorsal aspect.

to mid-September. Nowacka and Adamska-Wilczek (1974) found that two generations developed in the field on medicinal plants but that three generations were produced in an insectary. At Ithaca, N.Y., *E. atropunctata* is multivoltine, with at least four generations having been produced in 1981. The duration of the nymphal period as determined in the laboratory by Gromadzka tends to support our seasonal history observations. An incubation period of 9-13 days and a nymphal period of 18 days at 20°C and 21 days at 12.5°C suggest that during mid-summer only a month, or slightly longer, is required for the completion of a generation.

Host plants and damage.—In the herb and flower gardens at Ithaca, various mints appeared to be the preferred hosts (see Table 1), but nymphs also developed on *Althaea* spp., hollyhock (Malvaceae); *Primula japonica*, primrose (Primulaceae); and *Veronica* spp., speedwell (Scrophulariaceae). Along roadsides and in disturbed areas, we found that catnip, *Nepeta cataria*, and burdock, *Arctium minus*, were common hosts. *E. mellisae* often was present with *E. atropunctata* on catnip.

Injury became apparent by early May and was most visible on mints and

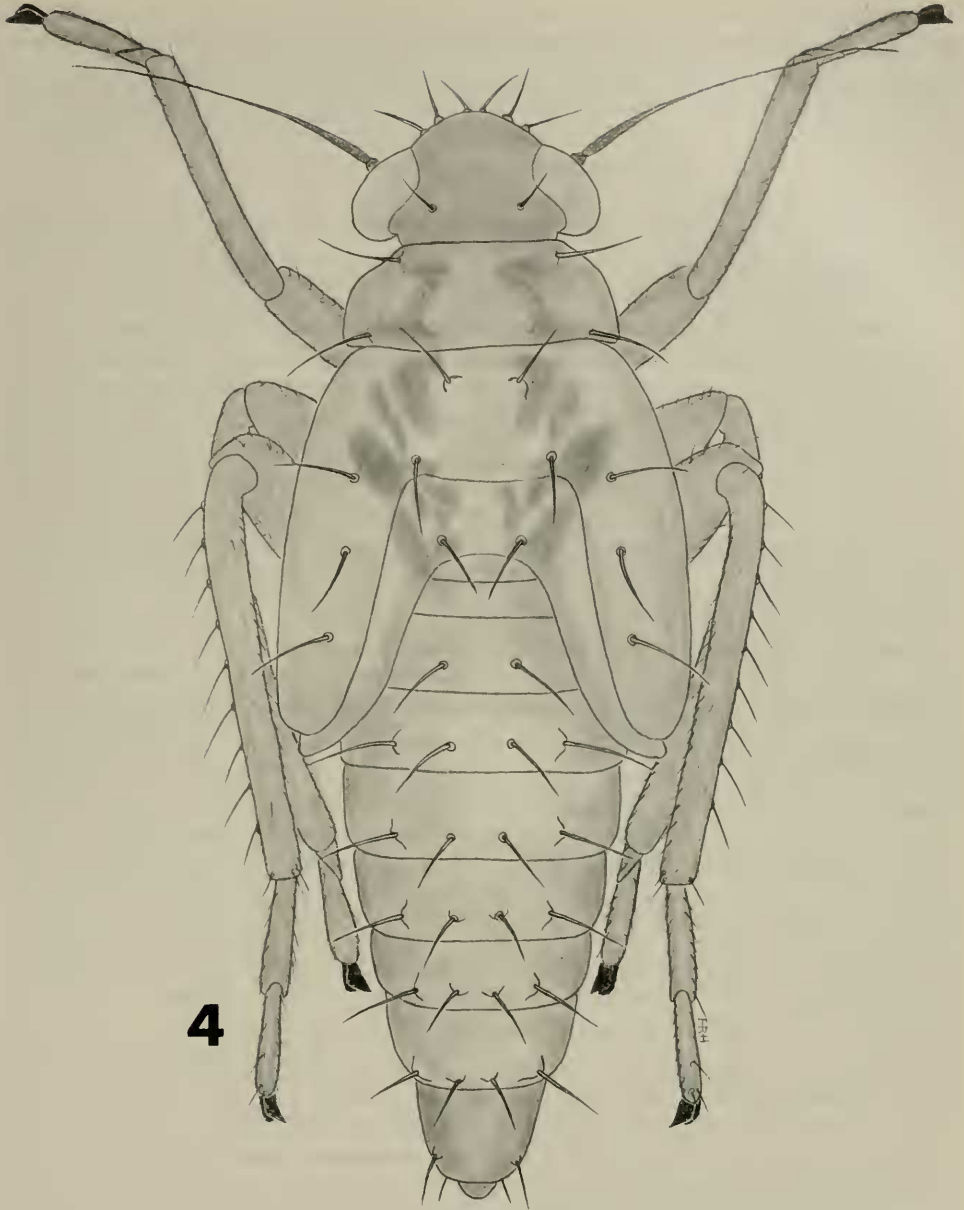


Fig. 4. *Eupteryx atropunctata*. Fifth-instar nymph, dorsal aspect.

burdock, least so on hollyhock. Nymphs and adults, which usually are observed on the undersides of host foliage, are said to probe the leaf surface and insert their stylets into palisade parenchyma of mesophyll tissue. According to Günthardt and Wanner (1981), they are able to survive only a few hours when confined to stems. These authors also found that *E. atropunctata* avoids strongly pubescent

plants, but from our observations they are often found on plants with pubescent foliage. Their sucking, typical of mesophyll-feeding leafhoppers (Smith and Poos, 1931), produces yellowish-white, chlorotic or stippled areas visible only on upper leaf surfaces (Fig. 2). In their comparative study of two typhlocybine leafhoppers developing on broad bean, *Vicia faba* L., Günthardt and Wanner considered the mesophyll-feeding *E. atropunctata* a more specialized feeder than *Empoasca decipiens* Paoli, a stem-parenchyma feeder.

Adult.—The adult of *E. atropunctata* (Fig. 3) is quite distinctive and readily distinguishable among other North American typhlocybine leafhoppers. The following description is drawn predominantly from Ossiannilsson (1981):

Overall length 3.4–3.8 mm. Dorsal coloration whitish yellow, usually with a green tinge. Vertex with 2 large rounded or quadrangular black spots, usually not extending to anterior margin of head. Pronotum usually with 2 pairs of black spots, the anterior-median pair smaller and often confluent, the lateral pair larger, rectangular and widely separated. Scutellum with 2 large black spots, one at each anterior corner. Forewing with 2 prominent black spots, one on middle of clavus and another at costal border. In addition, a more or less distinct oblique black or fuscous streak usually present in subcostal and radial cells. Apex of clavus fuscous; diffuse fuscous longitudinal band in cubital and median cells present or absent. Male genitalia figured in Ossiannilsson (1981).

Description of fifth-instar nymph (in alcohol), Fig. 4.—Length 2.7–3.1 mm (\bar{x} = 2.92, n = 5). Color pale greenish or yellowish, with long, erect setae dorsally. Infuscated areas on pronotum, meso- and metanotum producing a variable, yet characteristic pattern (see Fig. 4). *Head*: Length 0.26–0.30 mm, width across eyes 0.70 mm. Two pairs of setae on anterior margin; 1 pair of setae on vertex. *Rostrum*: Length 0.26–0.30 mm, extending to metacoxae. *Antenna* (including basal segments): Length 1.0–1.06 mm; 2 basal segments short, cylindrical; flagellum long and threadlike, thickened at base. *Pronotum*: Length 0.20–0.26 mm, median width 0.60–0.70 mm, lateral-anterior and lateral-posterior angles each with an erect, long seta. *Meso- and metanotum*: Length along median line 0.60–0.70 mm, median width across wing pads 1.0–1.1 mm; forewing pads extending to apex of abdominal segment IV. Mesonotum with 2 pairs of setae: 1 pair near anterior margin, one seta on each side of midline, approximate; 1 pair near posterior margin, one seta on each side of midline, widely separated. Metanotum with 1 pair of setae along posterior margin, one seta on each side of midline. Forewing pads each with 3 long, erect setae, widely separated, arranged nearly linearly as in Fig. 4. *Abdomen*: 10-segmented, broadly tapered to apex. Segments I and II small, devoid of setae. Segment III with 1 pair of setae, one seta on each side of midline. Segments IV–VIII each with 2 pairs of setae, one pair on each side of midline. Segment IX with 1 pair of setae, one seta on each side of midline along lateral margin.

Specimens examined: five fifth-instar nymphs, collected from foliage of catnip, *Nepeta cataria*, at State College (Centre Co.), Pennsylvania, 18 May 1981, by A. G. Wheeler, Jr. Determined by rearing and association with adults. Specimens have been deposited in the collections of Cornell University and the Pennsylvania Department of Agriculture.

ACKNOWLEDGMENTS

We express our appreciation to J. F. Stimmel (Bureau of Plant Industry, Pa. Department of Agriculture, Harrisburg, Pa.) for the photographs of feeding damage and the adult of *E. atropunctata*.

LITERATURE CITED

- Beirne, B. P. 1956. Leafhoppers (Homoptera: Cicadellidae) of Canada and Alaska. *Can. Entomol.* 88(suppl. 2): 1-180.
- Blattny, C. 1924. Skudcove a nekteere choroby rostlin lecivych v roce 1923 [Injury and some diseases of medicinal plants in 1923]. *Ochr. Rostl.* 4: 10-12.
- Curtis, J. 1860. *Farm insects: Being the natural history and economy of the insects injurious to the field crops of Great Britain and Ireland, and also those which infest barns and granaries, with suggestions for their destruction.* John Van Voorst, London. 528 pp.
- Douglas, J. W. 1879. Notes on some species of British Hemiptera. *Entomol. Mon. Mag.* 15: 253-255.
- Fokker, A. J. F. 1891. *Catalogus der in Nederland voorkomende Hemiptera.* Tijdschr. Entomol. 34: 357-378.
- Gromadzka, J. 1970. Observations on the biology and occurrence of leafhoppers *Eupteryx atropunctata* (Goeze) and *Empoasca pteridis* (Dhlb.) (Homoptera, Typhlocibidae) on potatoes. *Pol. Pismo Entomol.* 40: 829-840. (In Polish with English summary.)
- Günthardt, M. S. and H. Wanner. 1981. The feeding behaviour of two leafhoppers on *Vicia faba*. *Ecol. Entomol.* 6: 17-22.
- Günthart, H. 1971. Beitrag zur Kenntnis der Kleinzikaden (Typhlocybinae, Hem., Auch.) der Schweiz. *Mitt. Schweiz. Entomol. Ges.* 43: 218-224.
- Heinze, K. 1937. Zur Frage der Uebertragung der Kartoffelvirosen durch Jassiden. *Phytopathol. Z.* 10: 606-613.
- Hoebeke, E. R. 1980. A leafhopper (*Eupteryx atropunctata* (Goeze)). *Coop. Plant Pest Rep.* 5(29): 547.
- Horne, A. S. and H. M. Lefroy. 1915. Effects produced by sucking insects and red spider upon potato foliage. *Ann. Appl. Biol.* 1: 370-386.
- Leonard, M. D. and G. W. Barber. 1923. The immature stages of the catnip leafhopper. *J. N.Y. Entomol. Soc.* 31: 181-184.
- LeQuesne, W. J. 1973. *Eupteryx origani* Zakhvatkin (Hem., Cicadellidae) new to Britain, and related species. *Entomol. Mon. Mag.* 110: 203-206.
- Linnavuori, R. 1952. Havaintoja etelä-ja pohjois-Savon nivelkärsäisäläimistöistä. *Ann. Entomol. Fenn.* 18: 64-75.
- McAtee, W. L. 1919. Preliminary key to the Nearctic species of *Eupteryx* (Homoptera: Eupterygidae). *Entomol. News* 30: 182-186.
- Metcalf, Z. P. 1968. General catalogue of the Homoptera. Fasc. VI. Cicadelloidea. Part 17, Cicadellidae. U.S. Dep. Agric., Agric. Res. Serv., Washington, D.C., pp. 1-1513.
- Moore, G. A. 1950. Check-list of Hemiptera of the province of Quebec. *Contrib. Inst. Biol. Univ. Montreal* 26: 1-49 (Reprinted in *Nat. Can.* 77: 233-271.)
- Müller, H. J. 1957. Über die diapause von *Stenocranus minutus* Fabr. (Homoptera: Auchenorrhyncha). (Zugleich 6. Beitrag zur Biologie mitteleuropäischer Zikaden.) *Beitr. Entomol.* 7: 203-226.
- Nast, J. 1972. *Palaearctic Auchenorrhyncha (Homoptera), an annotated check list.* Polish Scientific Publishers, Warszawa. 550 pp.
- Nowacka, W. and J. Adamska-Wilczek. 1974. Leafhoppers (Homoptera, Cicadodea), pests of the medical plants. *Pol. Pismo Entomol.* 44: 393-404. (In Polish with English summary.)
- Nowacka, W. and J. Bielejewski. 1978. Leafhoppers (Homoptera, Cicadoidea) pests of the sunflower crops. *Rocz. Nauk Roln. (E)* 8: 203-214. (In Polish with English summary.)
- Osborn, H. 1929. Leaf-hopper immigrants of economic interest. *J. Econ. Entomol.* 22: 209-213.
- Ossiannilsson, F. 1943. Studier över de Svenska potatisfältens insektfauna och dess betydelse för

- spridning av virussjukdomar. I. Hemiptera, förekomst och utbredning. Meddn. St. VäxtskAnst. 39: 1-72.
- . 1981. The Auchenorrhyncha (Homoptera) of Fennoscandia and Denmark. Part 2: The families Cicadidae, Cercopidae, Membracidae, and Cicadellidae (excl. Deltocephalinae). Fauna Entomol. Scand. 7 (part 2): 223-593.
- Quaintance, A. L. 1913. Remarks on some of the injurious insects of other countries. Proc. Entomol. Soc. Wash. 15: 54-83.
- Schiemenz, H. 1969. Die Zikadenfauna mitteleuropäischer Trockenrasen (Homoptera, Auchenorrhyncha)—Untersuchungen zu ihrer Phänologie, Ökologie, Bionomie und Chorologie. Entomol. Abh. (Dres.) 36: 201-280.
- Smith, F. F. and F. W. Poos. 1931. The feeding habits of some leafhoppers of the genus *Empoasca*. J. Agric. Res. 43: 266-285.